

WHAT IS CLAIMED IS:

1. An incubator for receiving a plurality of reaction receptacles containing reaction fluids and for maintaining the reaction fluids in a temperature controlled environment, said incubator comprising:

a housing including a receptacle access opening formed therein for allowing movement of a reaction receptacle into or out of said housing through said receptacle access opening;

a command-responsive closure mechanism connected to said housing in proximal relation to said receptacle access opening, said command-responsive closure mechanism being constructed and arranged to be movable between a closed position and an open position with respect to said receptacle access opening in response to corresponding closure movement commands to prevent or permit access to said housing through said access opening,

said housing and said command-responsive closure mechanism constituting an enclosure defining an incubation chamber therein;

a heat source in thermal communication with said incubation chamber;

a powered fan mechanism disposed within said incubation chamber and constructed and arranged to generate air movement within said incubation chamber to promote a generally uniform temperature distribution internal to said incubation chamber; and

a receptacle carrier disposed within said incubation chamber and including a plurality of receptacle stations, each of said receptacle stations being constructed and arranged to carry a single reaction receptacle, said receptacle carrier being constructed and arranged to present any of said plurality of receptacle stations in a receptacle transfer position with respect to said access opening.

2. The incubator of claim 1, further comprising a receptacle mixing mechanism mounted on said housing and constructed and arranged to agitate a reaction receptacle carried in a one of said receptacle stations disposed in an operative position with respect to said mixing mechanism to thereby mix a reaction fluid contained in the reaction receptacle.

3. The incubator of claim 2, wherein said receptacle mixing mechanism comprises:
a motor;

a shaft operatively coupled to said motor, at least a portion of said shaft extending into said housing; and

a disk mounted on the portion of said shaft disposed within said housing, said disk mounted in such a manner that the plane of the disk is disposed at an acute angle with respect to the longitudinal axis of said shaft.

4. The incubator of claim 1, wherein said command-responsive closure mechanism comprises a door mounted to said housing so as to be rotatable with respect thereto, and wherein movement of said door between said closed and open positions is effected by rotation of said door.

5. The incubator of claim 4, wherein said command-responsive closure mechanism further comprises a motor operatively coupled to said door for effecting powered rotation of said door.

6. The incubator of claim 4, further comprising a position encoder operatively coupled to said door and constructed and arranged to indicate a rotational position of said door.

7. The incubator of claim 5, wherein said door comprises:
an arcuate closure panel;
a hinge plate extending transversely from an end of said closure panel, said hinge plate being rotatably secured relative to said housing; and
a lower actuating plate extending transversely from an opposite end of said closure panel, said lower actuating plate being coupled to said motor for transferring powered rotation of a shaft of said motor to rotation of said closure panel.

8. The incubator of claim 1, wherein said heat source comprises electrically-resistive heating coils secured to one or more surfaces of said housing.

9. The incubator of claim 1, further comprising a heat sensor constructed and arranged to measure the temperature within said incubation chamber.

10. The incubator of claim 1, wherein said housing includes one or more openings formed therein to permit access to a reaction receptacle carried in said housing to allow fluid

transfer to or from said reaction receptacle while said reaction receptacle is carried in said housing.

11. The incubator of claim 1, wherein said receptacle carrier comprises a carousel rotatably mounted within said housing and constructed and arranged to carry a reaction receptacle in each of said receptacle stations, said receptacle stations being arranged circumferentially about said carousel.

12. The incubator of claim 11, further comprising a position encoder operatively coupled to said carousel and constructed and arranged to indicate a rotational position of said carousel.

13. The incubator of claim 11, wherein each of said receptacle stations is elongated in a radial direction with respect to said carousel to accommodate an elongated reaction receptacle and to carry the reaction receptacle supported in a radial orientation.

14. The incubator of claim 11, further comprising shelves disposed along opposite sides of each of said receptacle stations for supporting a projecting rib structure disposed on opposite sides of a reaction receptacle carried therein.

15. The incubator of claim 11, further comprising:
a pulley wheel coaxially mounted to said carousel;
a motor mounted to said housing and having an output shaft; and
a belt trained around said pulley wheel and said output shaft for transferring powered rotation of said output shaft to said pulley wheel.

16. The incubator of claim 1, said receptacle carrier further comprising one or more reaction receptacle sensors disposed with respect to each of said receptacle stations to sense the presence of a reaction receptacle in said receptacle station.

17. The incubator of claim 1, wherein said housing is generally cylindrical in shape and includes a generally circular lid.

18. The incubator of claim 17, wherein said housing is formed from aluminum.

19. The incubator of claim 1, further comprising feet supporting said housing, said feet being formed from material that is a poor thermal conductor.

20. The incubator of claim 1, further comprising thermal insulation substantially covering said housing.

21. The incubator of claim 1, wherein said powered fan mechanism comprises a motorized centrifugal fan located in a central portion of said incubation chamber.

22. The incubator of claim 1, further comprising a receptacle bridge extending outwardly from said housing from a location below said receptacle access opening for supporting a bottom surface of a reaction receptacle being transferred through said receptacle access opening.

23. The incubator of claim 1, further comprising
a second receptacle access opening formed in said housing for allowing movement of a reaction receptacle into or out of said housing through said second receptacle access opening;
and

a second command-responsive closure mechanism connected to said housing in proximal relation to said second receptacle access opening, said second command-responsive closure mechanism being constructed and arranged to be movable between a closed position and an open position with respect to said second receptacle access opening in response to corresponding closure movement commands to prevent or permit access to said housing through said second access opening.

24. An incubator for receiving a plurality of reaction receptacles containing reaction fluids and for maintaining the reaction fluids in a temperature controlled environment, said incubator comprising:

a housing including a receptacle access opening formed therein for allowing movement of a reaction receptacle into or out of said housing through said receptacle access opening;

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a command-responsive closure mechanism connected to said housing in proximal relation to said receptacle access opening, said command-responsive closure mechanism being constructed and arranged to be movable between a closed position and an open position with respect to said receptacle access opening in response to corresponding closure movement commands to prevent or permit access to said housing through said access opening,

said housing and said command-responsive closure mechanism constituting an enclosure defining an incubation chamber therein;

a heat source in thermal communication with said incubation chamber;

a receptacle carrier disposed within said incubation chamber and including a plurality of receptacle stations, each of said receptacle stations being constructed and arranged to carry a single reaction receptacle, said receptacle carrier being constructed and arranged to present any of said plurality of receptacle stations in a receptacle transfer position with respect to said access opening; and

a receptacle mixing mechanism mounted on said housing and constructed and arranged to agitate a reaction receptacle carried in a one of said receptacle stations disposed in an operative position with respect to said mixing mechanism to thereby mix a reaction fluid contained in the reaction receptacle.

25. The incubator of claim 24, wherein said command-responsive closure mechanism comprises a door mounted to said housing so as to be rotatable with respect thereto, and wherein movement of said door between said closed and open positions is effected by rotation of said door.

26. The incubator of claim 25, wherein said command-responsive closure mechanism further comprises a motor operatively coupled to said door for effecting powered rotation of said door.

27. The incubator of claim 25, further comprising a position encoder operatively coupled to said door and constructed and arranged to indicate a rotational position of said door.

28. The incubator of claim 26, wherein said door comprises:
an arcuate closure panel;

a hinge plate extending transversely from an end of said closure panel, said hinge plate being rotatably secured relative to said housing; and

a lower actuating plate extending transversely from an opposite end of said closure panel, said lower actuating plate being coupled to said motor for transferring powered rotation of a shaft of said motor to rotation of said closure panel.

29. The incubator of claim 24, wherein said receptacle mixing mechanism comprises:
a motor;

a shaft operatively coupled to said motor, at least a portion of said shaft extending into said housing; and

a disk mounted on the portion of said shaft disposed within said housing, said disk mounted in such a manner that the plane of the disk is disposed at an acute angle with respect to the longitudinal axis of said shaft.

30. The incubator of claim 24, further comprising

a second receptacle access opening formed in said housing for allowing movement of a reaction receptacle into or out of said housing through said second receptacle access opening;
and

a second command-responsive closure mechanism connected to said housing in proximal relation to said second receptacle access opening, said second command-responsive closure mechanism being constructed and arranged to be movable between a closed position and an open position with respect to said second receptacle access opening in response to corresponding closure movement commands to prevent or permit access to said housing through said second access opening.